Received: 24 September 2019 | Revised: 17 December 2019 | Accepted: 27 December 2019

DOI: 10.1002/ccr3.2742

CASE REPORT

Clinical Case Reports Open Access WILEY

Parenchyma sparing multicomponent liver resection strategy for multiple bilobar synchronous colorectal cancer metastasis

Anton Anatoliyovych Burlaka | **Olena Oleksandrivna Kolesnik**

Abdominal Department, National Cancer Institute, Kyiv, Ukraine

Correspondence
Anton Anatoliyovych Burlaka, Abdominal Department, National Cancer Institute, Lomonosova 33/43, Kyiv 03022, Ukraine.
Email: nir.burlaka@gmail.com

Abstract

A two-stage multicomponent parenchymal sparing surgical strategy (anatomical extended on left hepatic vein 2-nd segment liver resection and R1vascular approach) allows the successful resection of synchronous multiple bilobar CRC metastases.

KEYWORDS

multicomponent strategy, parenchyma sparing multicomponent liver resection, R1 vascular

1 | INTRODUCTION

Liver resection remains the main strategy in case of primary malignancies and metastatic liver injury by colorectal cancer (CRC). The parenchyma sparing strategy in liver surgery has proven as an effective way of acute liver failure prevention, "small-for-size" liver syndrome, and oncological safety.[1,2] Successful resection should be considered when the preserved part of the liver parenchyma has not only adequate blood inflow through the system of the hepatic artery and portal vein, but also effective drainage into the system of the inferior vena cava. That is why, avoiding venous congestion causing the dysfunction of regeneration processes and in the worst cases tissue necrosis considered a significant factor in liver interventions planning.[3] Resection of the left lateral section of the liver is a routine approach in cases of the 2nd liver segment tumor localization which has invasion to the left hepatic vein (LHV). Earlier such a tactic was justified by the risk of venous congestion for parenchyma of the 3rd segment.

Nowadays, the use of $R1_{vascular}$ is not the standard surgical approach in metastatic CRC liver.[4] However, more and more advanced specialized surgical centers are demonstrating the feasibility of using $R1_{vascular}$. In particular, the Italian team of surgeons reports that R1 is not uncommon in surgery for metastatic CRC and is registered in up to 30% of cases. A survey of 276 surgeons from 52 countries found that most of them support the technical need for $R1_{vascular}$, but emphasize that R0 remains the gold standard.[5]

The aim of our study is to demonstrate the technical aspects of how to adjust the alternative and multicomponent surgical approach in a case report of multiple bilobar synchronous liver metastasis of CRC in clinic of NCI.

2 | MATERIAL AND METHODS

Case report of performing a nonstandardized approach of liver resection in CRC patient with synchronous liver metastases who received treatment in 2019 in National Cancer Institute clinic is presented. Totally, 10 metastatic lesions were identified (Table 1). The primary tumor localized in sigmoid colon and K-Ras gene was wild type. MDT's decision was to conduct two-stage surgical treatment after three cycles of XELOX + bev. induction chemotherapy. Vascular invasion have been found in the left lobe, which determined metastatic lesions of the 2nd segment of the liver with vascular invasion into the proximal part of left hepatic vein (Figure 1C). In the right lobe, there was a metastasis which localized between 8th and 1st segments parenchyma and vascular contact with right portal vein bifurcation area documented. The last one had probable invasion to small Glissonean branches of the anterior (RAPV) and posterior sections (RPPV), as

Liver segments, No	Volume, cm^3	Characteristics of metastases
1	47.6	Segmental parenchyma invasion of lesion which localized between 1st and 8th segments
2	168	Two lesions with LHV invasion
3	73.6	No lesions
4	252.1	Seg4 sup. - one lesion with LHV invasion Seg4 inf. - one small lesion in parenchyma depth without vascular invasion
5	177.8	One lesion between 8th and 1st segments with vascular contact to right main Glissonean pedicle bifurcation; also two small lesions in peripheral part of segment 5
6	273.6	Two peripheral lesions
7	363.2	One lesion with possible vascular contact to RHV
8	354	One peripheral lesion

TABLE 1 Characteristics of liver metastases and volumetric data[a]

[a]The results of MRI and CT data obtained before the start of chemotherapy.

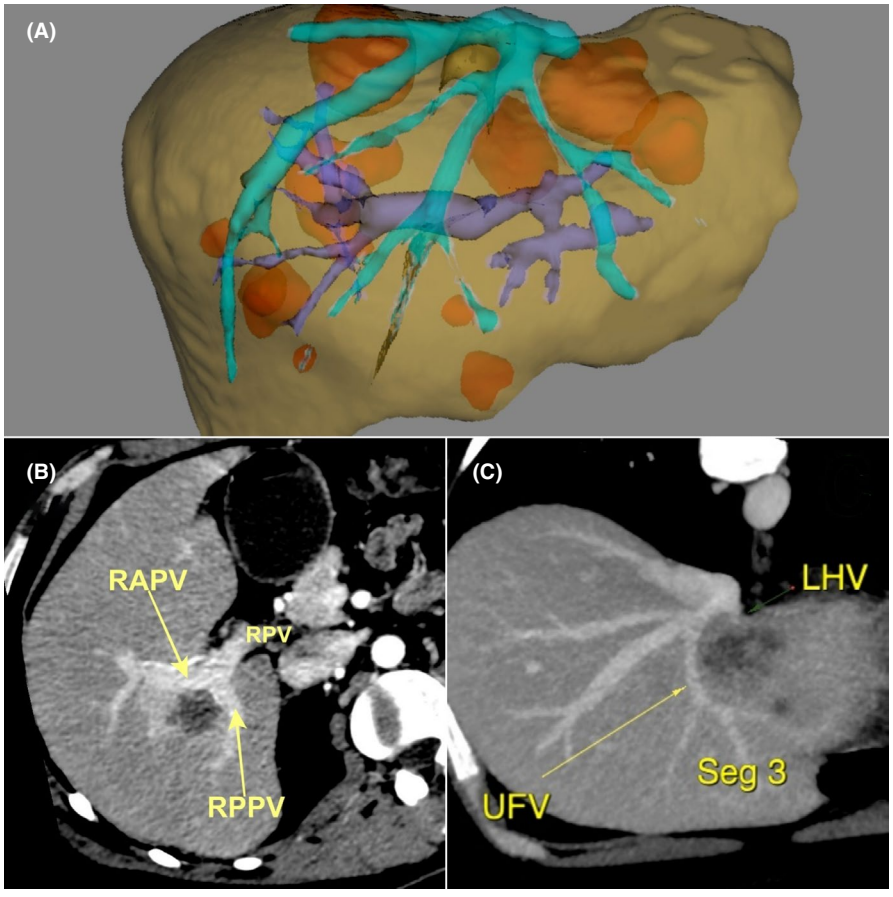

FIGURE 1 CT data: 3-D reconstruction (A) and axial scans (B, C) of the main liver vascular structures and metastases. Lesion with vascular contact to the bifurcation of the right main Glissonean pedicle (B). And 1 lesion in Seg2 with invasion to LHV (C)

well as vascular contact with distal segment of the right hepatic vein (RHV).

The results of laboratory tests and instrumental diagnostics were retrospectively analyzed. Preoperative examination included computed tomography (CT) with intravenous contrasting of the thoracic, abdominal and pelvic cavity, and magnetic resonance imaging (MRI) with hepatospecific contrast.

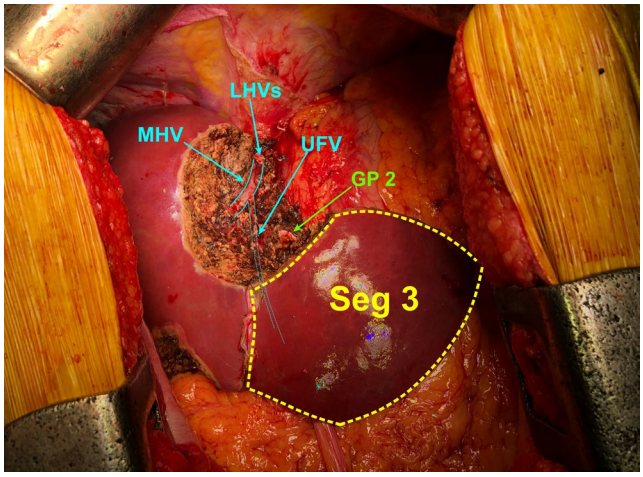

FIGURE 2 Operating field photograph: arrows indicate the main vascular structures. GP2, Glissonean pedicle stump of 2nd segment; LHVs, left hepatic vein stump; MHV, middle hepatic vein; Seg 3, 3rd liver segment; UFV, umbilical fissure vein

Surgical technique involved performing resection with the maximum possible preservation of the parenchyma and making resection margin ≥1 mm. $R1_{vascular}$ used only in case of exclusion of tumor "true" invasion into the vascular structures 1-3 order. Intraoperative ultrasound (IUD) routinely used to mark the lesions and find hepatic veins and Glissonean structures, as well as to mark metastases that could not be detected by CT or MRI. The ischemia technique involved the use of a Pringle maneuver (MP, 20 minutes—ischemia, 5 minutes—reperfusion). Parenchyma transection dissected using the "crashclamp" method. Hemostasis of the parenchyma performed with suturing of prolene 4.0, 5.0, bipolar forceps, and clipping LT-200, LT-300.

Liver function evaluated using a Child-Turcotte-Pugh scale and MELD. Manifestations of chemotherapy toxicity recorded according to the CTCAE 5.0 criteria. The degree of complication of acute liver failure (GPN) in the postoperative period was determined using the classification of the International Study Group of Liver Surgery (ISGLS).

2.1 | Examination results and planning of treatment tactics

The total liver volume and target volume of each segment calculated according to the 8-segment anatomy classification by Couinaud's (Table 1).

The total metastasis tissue volume was 121.2 cm^3 (6.3% of the total liver volume), the total volume of the liver was 1880 cm^3, and the functional liver volume was 1710 cm^3.

Considering clinical data, MDT recommendation was to apply the two-stage surgical strategy after induction chemotherapy (in case of stabilization/regression simultaneous

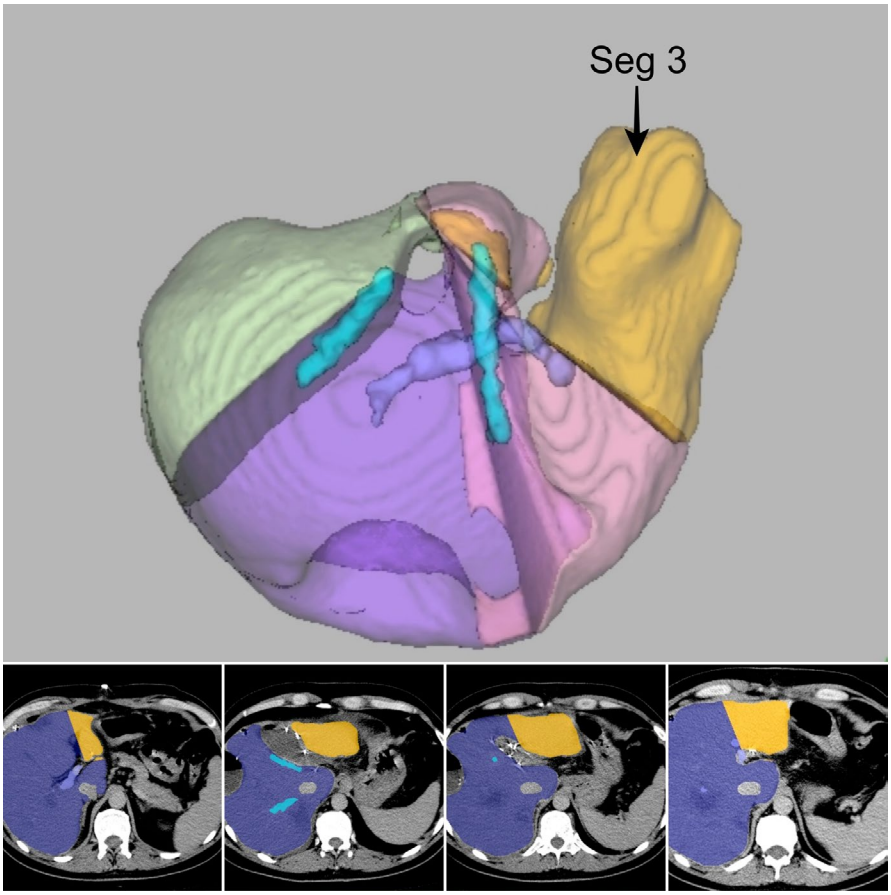

FIGURE 3 CT scan reconstruction on the 14th postoperative day. Seg 3 is hypertrophied without sign of venous congestion

surgery of primary tumor and parenchyma sparing resection of left liver lobe should be applied). Following absence of disease progression signs, 3 months of chemotherapy with subsequent second surgical stage of the right liver lobe should be applied.

3 | SURGICAL TECHNIQUE

3.1 | I surgical stage

Induction chemotherapy resulted in growth stabilization (target lesions have decreased by 12%). Problem of tumor vascular invasion into the LHV and the need of parenchyma preserving technique forced us to consider alternative tactics. Regarding the clinical data was done an anatomical extended on left hepatic vein 2nd segment liver resection with preservation of the Seg 3 parenchyma, atypical liver resections of Seg 4,5,8 with sigmoid resection (D3 lymphatic dissection).

After the midline laparotomy, liver mobilization involved the dissection of the left triangular, round and falciform ligaments. IUD helped to confirm the vascular invasion, by 2/3 of the circumference of LHV on the length - 3.5 cm. Next, the projection of the Glissonean pedicles to the 2nd and 3rd segments recognized and the UFV and its branches to the 3rd segment were visualized. The surface of the caval portion of Seg 4 was marked for the resection, accordingly to the lesion spread. Plus 3 metastatic lesions in left lobe were marked.

Parenchyma transection included the inflow control by of selective PM. Applying the "crush-clamp" technique, the first step performed by dissection and ligation of the structures of the parenchyma of the liver between the anatomic border of the 2nd and 3rd segments from left to the level of the umbilical fissure. Atypical resection within the parenchyma of the caval portion of the Seg 4 with synchronous preservation of UFV wos done under the intraoperative image-guided system control. This stage completed by ligation of the Glissonean pedicles to 2nd segment and LHV (Figure 2). Control of the efficacy of venous outflow from the third segment was performed using IUD. The total duration of thermal ischemia during MP was 45 minutes.

The CT scan on 14 postoperative day, was without signs of venous congestion of Seg 3 liver parenchyma. Postoperative volumetry of segment III showed parenchyma hypertrophy ≥107% (segment III volume before resection was 73.6 and 152.6 cm^3 after) (Figure 3).

Based on our data, MDT has planned to perform the 2nd surgical stage of liver resection: anatomic resection of Seg 5 with $R1_{vascular}$ approach in case absence of "true" invasion to the main right Glissonean pedicle bifurcation

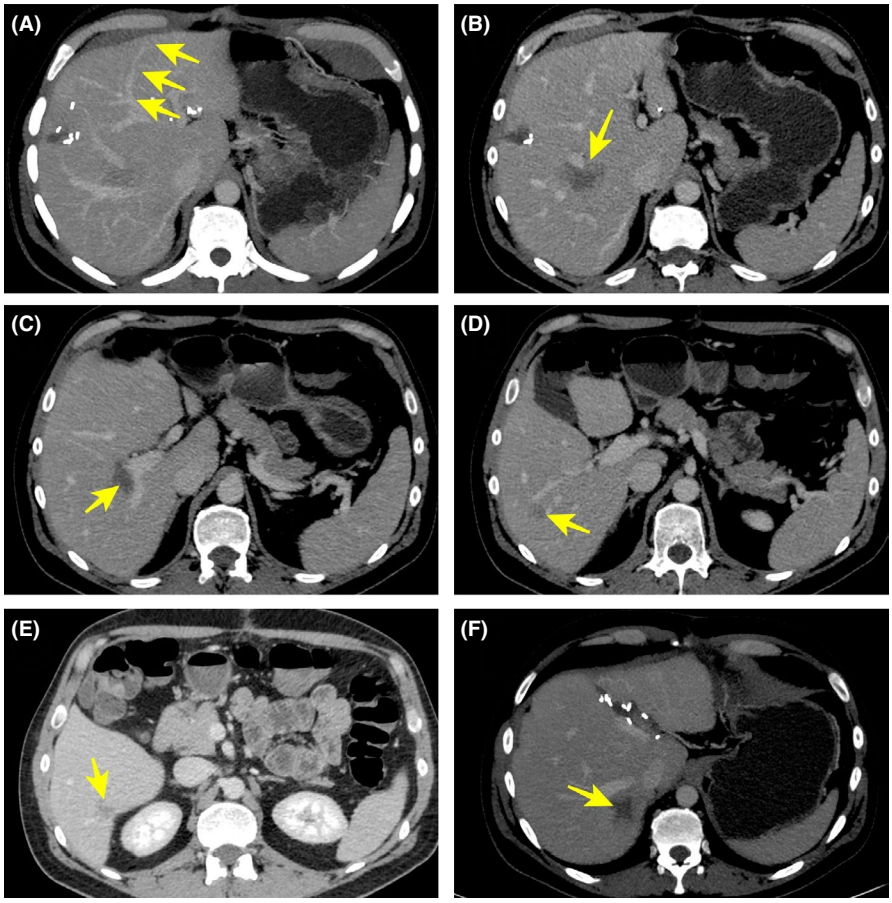

FIGURE 4 CT data through 3 mo after the I surgical stage. Target lesions decreased by 16%. A, UFV draining 3rd liver segment. B, lesion with vascular contact to the main right Glissonean pedicle bifurcation and anterior section, surround last one <90° with no evidence of invasion. C, Previously described metastatic lesion that contacts without signs of invasion to the posterior section Glissonean pedicle. D, Lesion on the border of Seg 5/6. E, Lesion in Seg6. F, Lesion in the Seg 7 projection

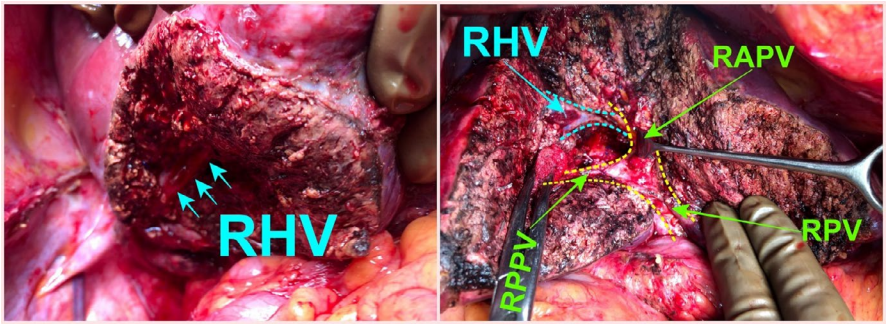

FIGURE 5 Photograph of surgical field of the II surgical stage; arrows indicate the main vascular structures. RHV, right hepatic vein; RPPV and RAPV, anterior and posterior branches of the right portal vein; RPV, main branch of right portal vein

(Figure 4B,C) and complete resection with parenchyma sparing surgery of other small metastatic lesions (Figure 4D-F).

3.2 | II surgical stage

After the J-shaped laparotomy and further viscerolysis, the mobilization of the right liver with total Piggy back maneuver was performed. Using the ultrasound navigation, projection of the 5th segment and all metastases markup completed. Anatomic resection of the 5th segment possessed the transparenchymal access to the anatomic area RAPV and RPPV, where resection with a 1 mm width margin of metastasis and "vascular detachment" in the projection of the vascular contact was done (Figure 5). The resection was completed with resection of four small lesions in the right liver lobe. Total duration of warm ischemia was 120 minutes.

The postoperative period was complicated with drained bile fistula, detected on three postoperative day (fistula treatment was conservative).

4 | DISCUSSION

It was described by transplantologists, that venous congestion of liver graft negatively affects the rate of regeneration and hypertrophy.[6] Extended on LHV 2nd segment liver resection is an effective alternative of parenchyma preserving method in cases of central LHV tumor invasion without the possibility of partial resection or reconstruction. K. Kobayashi et al have shown own results of such approach adjustment.[7] The authors believe that patients with multiple metastases and patients with small future liver remnant due to organ interventions and/or pathology (syndrome of sinusoidal obstruction, steatosis, viral hepatitis) should be ideal cases for anatomical extended on LHV 2nd segment liver resection. CT data and liver revision on II surgical stage of this case repost confirmed the fact that UFV is able independently drain venous blood from the isolated 3rd segment of the liver. UFV is third-order hepatic vein flowing in to the MHV or to the LHV-MHV confluence zone and drain blood from liver parenchyma between the left lateral section and 4th segment.[8]

Applying the $R1_{vascular}$ resection approach is an appropriate and conditionally safe method from the oncological point of view in CRC patients.[9] However, if true vascular invasion is confirmed, liver resection should be performed in a single block with a vascular component. We successfully adapted $R1_{vascular}$ resection approach in current case report, which had become a part of multicomponent nonstandard surgical parenchyma sparing liver surgery.

In this case report, we have demonstrated the effectiveness of an alternative multicomponent surgical strategy, including two-stage parenchymal sparing liver resection escaping the sophisticated methods causing the liver hypertrophy. This approach made possible through only the use of advanced surgical techniques: $R1_{vascular}$, IUD navigation, and understanding of the third- and fourth-order liver vascular anatomy.

5 | CONCLUSIONS

A two-stage multicomponent parenchymal sparing surgical strategy allows the successful resection of synchronous multiple bilobar CRC metastases and primary colon tumor. Anatomical extended on left hepatic vein 2nd segment liver resection and umbilical fissure vein preservation is an effective alternative parenchymal preservation approach for liver resections. $R1_{vascular}$ is a necessary element of a multicomponent liver surgical strategy for colorectal cancer with bilobar liver metastases.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

AB: collected the data, performed the analysis, wrote the paper. OK: designed and directed the project.

ORCID

Anton Anatoliyovych Burlaka https://orcid.org/0000-0003-4995-705X

REFERENCES

1. Hosokawa I, Allard MA, Mirza DF, et al. Outcomes of parenchyma-preserving hepatectomy and right hepatectomy for solitary small colorectal liver metastasis: a LiverMetSurvey study. *Surgery*. 2017;162(2):223-232.
2. Burlaka P, Ganusevich II, Vovk AV, Burlaka AA, Gafurov MR, Lukin SN. Colorectal cancer and mitochondrial dysfunctions of the adjunct adipose tissues: a case study. *Biomed Res Int*. 2018;2018:2169036.
3. Yoshida M, Beppu T, Shiraishi S, et al. Liver function in areas of hepatic venous congestion after hepatectomy for liver cancer: (99m)Tc-GSA SPECT/CT fused imaging study. *Anticancer Res*. 2018;38(5):3089-3095.
4. National Comprehensive Cancer Network. Bone Cancer (Version 2.2019). https://www.nccn.org/professionals/physician_gls/pdf/colon.pdf. Accessed November 22, 2019.
5. Viganò L, Costa G, Cimino MM, et al. R1 resection for colorectal liver metastases: a survey questioning surgeons about its incidence, clinical impact, and management. *J Gastrointest Surg*. 2018;22(10):1752-1763.
6. Umehara M, Narumi S, Sugai M, et al. Hepatic venous outflow obstruction in living donor liver transplantation: balloon angioplasty or stent placement? *Transplant Proc*. 2012;44(3):769-771.
7. Kobayashi K, Hasegawa K, Kokudo T, et al. Extended segmentectomy II to left hepatic vein: importance of preserving umbilical fissure vein to avoid congestion of segment III. *J Am Coll Surg*. 2017;225(3):e5-e11.
8. Tani K, Shindoh J, Akamatsu N, et al. Venous drainage map of the liver for complex hepatobiliary surgery and liver transplantation. *HPB (Oxford)*. 2016;18:1031e1038.
9. Torzilli G, Adam R, Viganò L, et al. Surgery of colorectal liver metastases: pushing the limits. *Liver Cancer*. 2016;6(1):80-89.

How to cite this article: Burlaka AA, Kolesnik OO. Parenchyma sparing multicomponent liver resection strategy for multiple bilobar synchronous colorectal cancer metastasis. *Clin Case Rep*. 2020;8:661–666. https://doi.org/10.1002/ccr3.2742